

# Executive Summary

## Direction 2050: Danish CCUS Roadmap 2024

The Danish CCUS Roadmap 2024 outlines the status of CCUS development in Denmark and showcases pioneering technologies within the field. From a scientific standpoint, the roadmap provides detailed insight into the development, challenges, and opportunities associated with the key CCUS technologies.

The Roadmap offers a perspective on the various paths Denmark can pursue to innovate and implement CCUS at the scale required to help reach our climate goals. Denmark holds extensive expertise across the CCUS technologies and targeted research has paved the way for the implementation of crucial technologies.

With the purpose of strengthening Denmark's position as a frontrunner in the CCUS field, the updated CCUS Roadmap can serve as a future national standard for formulating CCUS strategies, guiding political ambitions, and objectives on reduction quantities and timelines.

The CCUS Roadmap 2024 clearly demonstrates that Danish research and innovation in CCUS have played and will continue to play a crucial role in enabling Denmark to meet its climate goals and inspire others to implement carbon capture, utilization, and storage to combat climate change.

However, the updated CCUS Roadmap 2024 also shows that the pace of research and innovation must be maintained and intensified with new project models and forms of collaboration towards 2050, focusing on technology development as well as cost and energy consumption reduction.



### **Capture and storage from point sources play a crucial role in achieving Denmark's climate goals.**

By 2040, the technical potential for capture and storage of fossil and biogenic CO<sub>2</sub> from point sources is estimated to 5-11 Mtpa. Research into capture at point sources is well-developed and drives innovation across the entire CCUS field.



### **Effective capture at point sources requires research into targeted capture technologies.**

To scale capture technologies the pace of research needs to increase and be targeted Denmark's major emitters with research in capture technologies adapted each type of point source. A credible market for voluntary credits can be established as an incentive for research and implementation.



### **There is significant untapped potential in geological storage in Denmark.**

Importing CO<sub>2</sub> and developing infrastructure will be beneficial for developing a reliable business model for storage operators by 2030 and beyond. Facilitating a coordinated research effort aimed at monitoring technologies and the maturation and operation of facilities is essential.



### **More research is needed in the utilization of CO<sub>2</sub> if it is to play a role by 2050.**

Most solutions are at an immature technological level and a greater variety is needed to ensure the establishment of a CO<sub>2</sub> cycle with a focus on utilization. Better knowledge of the reduction potential is necessary. Research must increase before a nascent technology can mature.



### **International collaboration on DAC should be strengthened to assess the potential in Denmark.**

Several DAC initiatives are under development and implementation around the world. Energy intensity, adequate capture rates, and scaling are challenges for the Danish development of DAC highlighting the need to explore how existing DAC initiatives can be integrated in Denmark.



### **Biochar from pyrolysis can deliver 1.5-2 Mtpa by 2050 with a strong focus on CCS for negative emissions.**

Sustained technological development is considered necessary to realize the potential. Widespread use of pyrolysis and biochar for CO<sub>2</sub> reductions requires available biomass and large land areas. Focus on intensified research is needed to achieve the needed technological level.